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Remarks:

This application was filed on 14 - 05 - 1998 as a
divisional application to the application mentioned
under INID code 62.

(54) **Modified high molecular weight succinimides**

(57) Alkenyl or alkyl succinimide additives which are
the reaction product of a high molecular weight alkenyl-
or alkyl-substituted succinic anhydride and a poly-
alkylene polyamine having an average of greater than 4
nitrogen atoms per mole, wherein the reaction product
is post-treated with a cyclic carbonate, are compatible
with fluorocarbon engine seals and, for concentration
levels at which fluorocarbon seal compatibility is
achieved, possess improved dispersancy and/or deter-
gency properties when employed in lubricating oils and
fuels.

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[illegible][illegible]

1. The first step is to identify the problem or question that needs to be answered. This involves understanding the context and the specific requirements of the task.

2. The second step is to gather relevant information and data. This can be done through research, consultation with experts, or by analyzing existing data sets.

3. The third step is to develop a plan or strategy to address the problem. This involves breaking down the problem into smaller, manageable parts and determining the best approach to solve each part.

4. The fourth step is to implement the plan. This involves carrying out the tasks and activities that have been identified in the plan.

5. The fifth step is to evaluate the results and make adjustments as needed. This involves comparing the actual results with the expected results and identifying any areas for improvement.

6. The sixth step is to document the findings and conclusions. This involves writing a report or summary that outlines the process and the results of the investigation.

7. The seventh step is to communicate the findings to the relevant stakeholders. This involves presenting the results in a clear and concise manner that is understandable to the intended audience.

8. The eighth step is to reflect on the process and learn from the experience. This involves considering what worked well, what didn't, and how the process can be improved for future projects.

9. The ninth step is to share the knowledge and insights gained from the project. This involves disseminating the findings to the wider community or industry, and contributing to the body of knowledge in the field.

10. The tenth step is to continue to monitor and evaluate the impact of the project. This involves tracking the progress of the project over time and assessing its long-term effects on the community or industry.

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1. La ley de la conservación de la materia establece que la materia no se crea ni se destruye, simplemente se transforma.

NOTICE IS HEREBY GIVEN

1. The first step in the process of identifying a problem is to define the problem. This involves identifying the symptoms of the problem and determining the scope of the problem. Once the problem has been defined, the next step is to identify the causes of the problem. This involves identifying the factors that are contributing to the problem and determining the underlying causes. Once the causes have been identified, the next step is to develop a plan of action. This involves identifying the steps that need to be taken to solve the problem and determining the resources that will be needed to implement the plan. Once a plan of action has been developed, the next step is to implement the plan. This involves carrying out the steps that have been identified in the plan and monitoring the progress of the implementation. Finally, the last step in the process is to evaluate the results of the implementation. This involves determining whether the problem has been solved and whether the resources have been used effectively.

15. THEY ARE NOT TO BE USED FOR THE PURPOSES OF

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polybutenes, an especially preferred Mn range is 1700-2400. However, the '435 patent also teaches that the succinimides must have a succinic ratio of at least 1.3, that is at least 1.3 succinic groups per equivalent weight of polyalkylene-derived substituent group. Most preferred are succinimides having a succinic ratio of 1.5-2.5. The '435 patent teaches that succinimides must have both a high Mn polyalkylene-derived substituent and a high succinic ratio.

5 The succinimide additives disclosed in the '435 patent are not only dispersants and/or detergents, but also viscosity index improvers. That is, the '435 additives impart fluidity modifying properties to lubricant compositions containing them. However, viscosity index improving properties are not always desirable for the succinimide, as in the case of single-grade oil formulations, for example.

10 Polyamino alkenyl or alkyl succinimides and other additives useful as dispersants and/or detergents, such as Mannich bases, contain basic nitrogen. While basicity is an important property to have in the dispersant/detergent additive, it is believed that the initial attack on fluorocarbon elastomer seals used in some engines involves attack by the basic nitrogen. This attack leads to the loss of fluoride ions, and eventually results in cracks in the seals and loss of other desirable physical properties in the elastomer.

15 One approach towards solving the elastomer problem is described in U.S. Patent No. 4,873,009 to Ronald L. Anderson. This patent is also concerned, in part, with the use of succinimides as lube oil additives. Anderson recognizes in Col. 2, lines 28 et seq. that lube additives prepared from "long chain aliphatic polyamines", i.e., succinimides, "are excellent lube oil additives." Anderson teaches such succinimides are "inferior to additives where the alkylene polyamine is hydroxyalkylated" (Col. 2, lines 31-32). Such hydroxyalkylated polyamine-based succinimides, however, "have the drawback that they tend to attack engine seals particularly those of the fluorocarbon polymer type" (Col. 2, lines 35-37).

20 Anderson solves his fluorocarbon polymer seal compatibility problem by directly borating his hydroxyalkylated polyamine based succinimides. Furthermore, according to Anderson, it would be desirable for the additive to have a relatively high concentration of N-hydroxyalkyl moieties because the more N-hydroxyalkyl substituents, the cleaner the engine. However, Anderson also teaches that the more amino groups in the polyamine, the greater the degradation of fluorocarbon seal, and that alkylene amines containing more than 2 amino groups cannot be utilized (Col. 2, lines 50-62).

Accordingly, there exists a need in the art for a succinimide lubricating oil additive which is effective in controlling engine sludge and varnish, but which does not require boration to achieve fluorocarbon seal compatibility.

30 SUMMARY OF THE INVENTION

A unique class of modified polyamino alkenyl or alkyl succinimide compounds has now been found to be simultaneously compatible with fluorocarbon seals and, at concentration levels for which fluorocarbon seal compatibility is achieved, effective in controlling engine sludge and varnish. These modified polyamino alkenyl or alkyl succinimides are prepared from the succinimide reaction product of 1) an alkenyl- or alkyl-substituted succinic anhydride derived from a polyolefin having a Mn of about 2000 to about 2700 and a weight average molecular weight (Mw) to Mn ratio of about 1 to about 5; and 2) a polyalkylene polyamine having greater than 4 nitrogen atoms per mole. The modified succinimides of the present invention are obtained by post-treating the succinimide reaction product with a cyclic carbonate.

40 Among other factors, the present invention is based on the finding that a unique class of succinimides is effective in controlling engine sludge and varnish at concentration levels for which the succinimides are simultaneously compatible with engine fluorocarbon seals. Generally, known succinimides useful as dispersants and/or detergents are not always compatible with fluorocarbon seals when present in lubricating oil compositions at concentration levels necessary to be effective in controlling engine sludge and varnish. Accordingly, the present invention also relates to a lubricating oil composition containing these modified polyamino alkenyl or alkyl succinimides.

45 Among other factors, the present invention is also based on the finding that a unique class of modified polyamino alkenyl or alkyl succinimides wherein the alkenyl or alkyl substituent has a Mn in the range of 2000-2700 possess both superior fluorocarbon seal compatibility and superior dispersancy and/or detergency properties compared to those wherein the alkenyl or alkyl substituent has a Mn of less than about 2000.

50 In addition to lubricating oil compositions, the present invention also relates to fuel compositions comprising a major portion of a hydrocarbon boiling in a gasoline or diesel range and an amount of a modified polyamino alkenyl or alkyl succinimide, compatible with fluorocarbon seals, sufficient to provide dispersancy and/or detergency.

DETAILED DESCRIPTION OF THE INVENTION

55 The modified polyamino alkenyl or alkyl succinimides of this invention are prepared by post-treating a polyamino alkenyl or alkyl succinimide with a cyclic carbonate. The polyamino alkenyl or alkyl succinimides are typically prepared by reaction of an alkenyl or alkyl succinic anhydride with a polyamine.

Alkenyl or alkyl succinimides are disclosed in numerous references and are well known in the art. Certain funda-

1. The first part of the problem is to find the value of the function $f(x)$ at $x = 1$.

2. The second part is to find the value of the function $f(x)$ at $x = 2$.

3. The third part is to find the value of the function $f(x)$ at $x = 3$.

4. The fourth part is to find the value of the function $f(x)$ at $x = 4$.

5. The fifth part is to find the value of the function $f(x)$ at $x = 5$.

6. The sixth part is to find the value of the function $f(x)$ at $x = 6$.

7. The seventh part is to find the value of the function $f(x)$ at $x = 7$.

8. The eighth part is to find the value of the function $f(x)$ at $x = 8$.

9. The ninth part is to find the value of the function $f(x)$ at $x = 9$.

$$f(x) = \frac{1}{x^2} \quad \text{for } x \neq 0$$

10. The tenth part is to find the value of the function $f(x)$ at $x = 10$.

$$f(x) = \frac{1}{x^2} \quad \text{for } x \neq 0$$

11. The eleventh part is to find the value of the function $f(x)$ at $x = 11$.

12. The twelfth part is to find the value of the function $f(x)$ at $x = 12$.

13. The thirteenth part is to find the value of the function $f(x)$ at $x = 13$.

14. The fourteenth part is to find the value of the function $f(x)$ at $x = 14$.

15. The fifteenth part is to find the value of the function $f(x)$ at $x = 15$.

16. The sixteenth part is to find the value of the function $f(x)$ at $x = 16$.

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M_{po} = number average molecular weight of the starting polyolefin

M_{ma} = 98 (molecular weight of maleic anhydride)

5 C = conversion factor = 112220 (for conversion of gram-moles of alkenyl or alkyl succinic anhydride per gram of sample to milligrams of KOH per gram of sample)

The saponification number, P, can be measured using known procedures, such as the procedure described in ASTM D94.

10 The actives fraction of the alkenyl or alkyl succinic anhydride can be determined from the percent of unreacted polyolefin according to the following procedure. A 5.0 gram sample of the reaction product of maleic anhydride and polyolefin is dissolved in hexane, placed in a column of 80.0 grams of silica gel (Davisil 62, a 140 angstrom pore size silica gel), and eluted with 1 liter of hexane. The percent unreacted polyolefin is determined by removing the hexane solvent under vacuum from the eluent and weighing the residue. Percent unreacted polyolefin is calculated according to the following formula:

$$\text{Percent Unreacted Polyolefin} = \frac{\text{Net Weight of Residue}}{\text{Sample Weight}} \times 100$$

20 The weight percent actives for the alkenyl or alkyl succinic anhydride product is calculated from the percent unreacted polyolefin using the formula:

$$\text{Weight Percent Actives} = 100 - \text{Percent Unreacted Polyolefin}$$

25 The actives fraction of the alkenyl or alkyl succinic anhydride is then calculated as follows:

$$\text{Actives Fraction} = \frac{\text{Weight Percent Actives}}{100}$$

The percent conversion of polyolefin is calculated from the weight percent actives as follows:

$$\text{Percent Conversion} = \frac{\text{wt. \% actives} \times \left[\frac{M_{po}}{M_{po} + [M_{ma} \times SR]} \right]}{\left[\text{wt. \% actives} \times \left[\frac{M_{po}}{M_{po} + [M_{ma} \times SR]} \right] \right] + [100 - \text{wt. \% actives}]}$$

40 wherein

M_{po} = number average molecular weight of the starting polyolefin

M_{ma} = 98 (molecular weight of maleic anhydride)

45 SR = succinic ratio of alkenyl or alkyl succinic anhydride product

50 It is, of course, understood that alkenyl or alkyl succinic anhydride products having high succinic ratios can be blended with other alkenyl succinic anhydrides having lower succinic ratios, for example, ratios of around 1.0, to provide an alkenyl succinic anhydride product having an intermediate succinic ratio.

In general, suitable succinic ratios for the alkenyl or alkyl succinic anhydride reactants employed in preparing the additives of this invention are greater than about 1 but less than about 2. Succinic anhydrides with succinic ratios of about 2, when reacted with amines having greater than 4 nitrogen atoms per mole and post-treated with a cyclic carbonate, form gels. Accordingly, succinic ratios of about 1.7 or less are preferred.

The Polyamino Reactant

The polyamine to be reacted with the alkenyl or alkyl succinic anhydride in order to produce the polyamino alkenyl

1. 1990年12月1日以前，在《民法通则》施行以前，即1986年4月1日以前，发生民事法律行为，适用行为发生时的法律。

1. The first step is to identify the problem or question that needs to be answered. This involves understanding the context and the specific requirements of the task.

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1. The following information was obtained from the records of the Federal Bureau of Investigation, Bureau of Prisons, and the United States Department of Justice, Office of the Inspector General, regarding the activities of the following individuals:

13. The following information was obtained from the records of the Department of the Interior, Bureau of Land Management, regarding the land owned by the United States in the State of Alaska, as of January 1, 1960:

1. The first group of people who are interested in the study of the history of the United States are the people who are interested in the history of the United States. This group includes the people who are interested in the history of the United States, the people who are interested in the history of the United States, and the people who are interested in the history of the United States.

[illegible][illegible]

1. The first step is to identify the key components of the system. This includes understanding the inputs, outputs, and internal processes.

...auf dem Boden der ...

1. *What is the purpose of the study?* The purpose of the study is to investigate the effect of the use of a mobile learning application on the learning outcomes of students in a distance education program.

2000-2001, 2001-2002, 2002-2003, 2003-2004, 2004-2005, 2005-2006, 2006-2007, 2007-2008, 2008-2009, 2009-2010, 2010-2011, 2011-2012, 2012-2013, 2013-2014, 2014-2015, 2015-2016, 2016-2017, 2017-2018, 2018-2019, 2019-2020, 2020-2021, 2021-2022, 2022-2023, 2023-2024, 2024-2025, 2025-2026, 2026-2027, 2027-2028, 2028-2029, 2029-2030, 2030-2031, 2031-2032, 2032-2033, 2033-2034, 2034-2035, 2035-2036, 2036-2037, 2037-2038, 2038-2039, 2039-2040, 2040-2041, 2041-2042, 2042-2043, 2043-2044, 2044-2045, 2045-2046, 2046-2047, 2047-2048, 2048-2049, 2049-2050, 2050-2051, 2051-2052, 2052-2053, 2053-2054, 2054-2055, 2055-2056, 2056-2057, 2057-2058, 2058-2059, 2059-2060, 2060-2061, 2061-2062, 2062-2063, 2063-2064, 2064-2065, 2065-2066, 2066-2067, 2067-2068, 2068-2069, 2069-2070, 2070-2071, 2071-2072, 2072-2073, 2073-2074, 2074-2075, 2075-2076, 2076-2077, 2077-2078, 2078-2079, 2079-2080, 2080-2081, 2081-2082, 2082-2083, 2083-2084, 2084-2085, 2085-2086, 2086-2087, 2087-2088, 2088-2089, 2089-2090, 2090-2091, 2091-2092, 2092-2093, 2093-2094, 2094-2095, 2095-2096, 2096-2097, 2097-2098, 2098-2099, 2099-2100, 2100-2101, 2101-2102, 2102-2103, 2103-2104, 2104-2105, 2105-2106, 2106-2107, 2107-2108, 2108-2109, 2109-2110, 2110-2111, 2111-2112, 2112-2113, 2113-2114, 2114-2115, 2115-2116, 2116-2117, 2117-2118, 2118-2119, 2119-2120, 2120-2121, 2121-2122, 2122-2123, 2123-2124, 2124-2125, 2125-2126, 2126-2127, 2127-2128, 2128-2129, 2129-2130, 2130-2131, 2131-2132, 2132-2133, 2133-2134, 2134-2135, 2135-2136, 2136-2137, 2137-2138, 2138-2139, 2139-2140, 2140-2141, 2141-2142, 2142-2143, 2143-2144, 2144-2145, 2145-2146, 2146-2147, 2147-2148, 2148-2149, 2149-2150, 2150-2151, 2151-2152, 2152-2153, 2153-2154, 2154-2155, 2155-2156, 2156-2157, 2157-2158, 2158-2159, 2159-2160, 2160-2161, 2161-2162, 2162-2163, 2163-2164, 2164-2165, 2165-2166, 2166-2167, 2167-2168, 2168-2169, 2169-2170, 2170-2171, 2171-2172, 2172-2173, 2173-2174, 2174-2175, 2175-2176, 2176-2177, 2177-2178, 2178-2179, 2179-2180, 2180-2181, 2181-2182, 2182-2183, 2183-2184, 2184-2185, 2185-2186, 2186-2187, 2187-2188, 2188-2189, 2189-2190, 2190-2191, 2191-2192, 2192-2193, 2193-2194, 2194-2195, 2195-2196, 2196-2197, 2197-2198, 2198-2199, 2199-2200, 2200-2201, 2201-2202, 2202-2203, 2203-2204, 2204-2205, 2205-2206, 2206-2207, 2207-2208, 2208-2209, 2209-2210, 2210-2211, 2211-2212, 2212-2213, 2213-2214, 2214-2215, 2215-2216, 2216-2217, 2217-2218, 2218-2219, 2219-2220, 2220-2221, 2221-2222, 2222-2223, 2223-2224, 2224-2225, 2225-2226, 2226-2227, 2227-2228, 2228-2229, 2229-2230, 2230-2231, 2231-2232, 2232-2233, 2233-2234, 2234-2235, 2235-2236, 2236-2237, 2237-2238, 2238-2239, 2239-2240, 2240-2241, 2241-2242, 2242-2243, 2243-2244, 2244-2245, 2245-2246, 2246-2247, 2247-2248, 2248-2249, 2249-2250, 2250-2251, 2251-2252, 2252-2253, 2253-2254, 2254-2255, 2255-2256, 2256-2257, 2257-2258, 2258-2259, 2259-2260, 2260-2261, 2261-2262, 2262-2263, 2263-2264, 2264-2265, 2265-2266, 2266-2267, 2267-2268, 2268-2269, 2269-2270, 2270-2271, 2271-2272, 2272-2273, 2273-2274, 2274-2275, 2275-2276, 2276-2277, 2277-2278, 2278-2279, 2279-2280, 2280-2281, 2281-2282, 2282-2283, 2283-2284, 2284-2285, 2285-2286, 2286-2287, 2287-2288, 2288-2289, 2289-2290, 2290-2291, 2291-2292, 2292-2293, 2293-2294, 2294-2295, 2295-2296, 2296-2297, 2297-2298, 2298-2299, 2299-2300, 2300-2301, 2301-2302, 2302-2303, 2303-2304, 2304-2305, 2305-2306, 2306-2307, 2307-2308, 2308-2309, 2309-2310, 2310-2311, 2311-2312, 2312-2313, 2313-2314, 2314-2315, 2315-2316, 2316-2317, 2317-2318, 2318-2319, 2319-2320, 2320-2321, 2321-2322, 2322-2323, 2323-2324, 2324-2325, 2325-2326, 2326-2327, 2327-2328, 2328-2329, 2329-2330, 2330-2331, 2331-2332, 2332-2333, 2333-2334, 2334-2335, 2335-2336, 2336-2337, 2337-2338, 2338-2339, 2339-2340, 2340-2341, 2341-2342, 2342-2343, 2343-2344, 2344-2345, 2345-2346, 2346-2347, 2347-2348, 2348-2349, 2349-2350, 2350-2351, 2351-2352, 2352-2353, 2353-2354, 2354-2355, 2355-2356, 2356-2357, 2357-2358, 2358-2359, 2359-2360, 2360-2361, 2361-2362, 2362-2363, 2363-2364, 2364-2365, 2365-2366, 2366-2367, 2367-2368, 2368-2369, 2369-2370, 2370-2371, 2371-2372, 23

1. The first of these is the fact that the Commission has not yet received any information from the Government of the United Kingdom regarding the proposed changes to the law on the right of asylum. This is a serious omission, as the Commission is unable to assess the impact of these changes on the rights of asylum seekers.

[illegible]

The following table shows the number of persons who have been convicted of a crime in the State of New York, and the number of persons who have been sentenced to the State Prison, for the years 1880, 1881, 1882, 1883, 1884, 1885, 1886, 1887, 1888, 1889, 1890, 1891, 1892, 1893, 1894, 1895, 1896, 1897, 1898, 1899, 1900, 1901, 1902, 1903, 1904, 1905, 1906, 1907, 1908, 1909, 1910, 1911, 1912, 1913, 1914, 1915, 1916, 1917, 1918, 1919, 1920, 1921, 1922, 1923, 1924, 1925, 1926, 1927, 1928, 1929, 1930, 1931, 1932, 1933, 1934, 1935, 1936, 1937, 1938, 1939, 1940, 1941, 1942, 1943, 1944, 1945, 1946, 1947, 1948, 1949, 1950, 1951, 1952, 1953, 1954, 1955, 1956, 1957, 1958, 1959, 1960, 1961, 1962, 1963, 1964, 1965, 1966, 1967, 1968, 1969, 1970, 1971, 1972, 1973, 1974, 1975, 1976, 1977, 1978, 1979, 1980, 1981, 1982, 1983, 1984, 1985, 1986, 1987, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 25

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These results indicate that the use of the proposed model in the context of corporate sustainability disclosure is effective. The model can be used to identify the factors that influence the disclosure of CSR information and to develop strategies to improve the disclosure of CSR information.

the number of moles of polyamine to the number of moles of succinic groups in the succinic anhydride reactant. The number of moles of succinic groups in the succinic anhydride reactant is determined as follows:

$$\text{number of moles of succinic groups} = \frac{P}{C} \times \text{weight of alkenyl or alkyl succinic anhydride sample (g)}$$

wherein P and C are as defined above.

POST-TREATMENT OF THE POLYAMINO ALKENYL OR ALKYL SUCCINIMIDE WITH A CYCLIC CARBONATE

The polyamino alkenyl or alkyl succinimides formed as described above are then reacted with a cyclic carbonate. The resulting modified polyamino alkenyl succinimide has one or more nitrogens of the polyamino moiety substituted with a hydroxy hydrocarbyl oxycarbonyl, a hydroxy poly(oxyalkylene) oxycarbonyl, a hydroxyalkylene, hydroxy-alkylenepoly(oxyalkylene), or mixture thereof. The products so produced are compatible with fluorocarbon seals and are effective dispersant and detergent additives for lubricating oils and for fuels.

The reaction of a polyamino alkenyl or alkyl succinimide with a cyclic carbonate is conducted at a temperature sufficient to cause reaction of the cyclic carbonate with the polyamino alkenyl or alkyl succinimide. In particular, reaction temperatures of from about 0°C to about 250°C are preferred with temperatures of from about 100°C to 200°C being more preferred and temperatures of from 150°C to 180°C are most preferred.

The reaction may be conducted neat, wherein both the alkenyl or alkyl succinimide and the cyclic carbonate are combined in the proper ratio, either alone or in the presence of a catalyst (such as an acidic, basic or Lewis acid catalyst), and then stirred at the reaction temperature. Examples of suitable catalysts include, for instance, phosphoric acid, boron trifluoride, alkyl or aryl sulfonic acid, alkali or alkaline carbonate.

Alternatively, the reaction may be conducted in a diluent. For example, the reactants may be combined in a solvent such as toluene, xylene, oil or the like, and then stirred at the reaction temperature. After reaction completion, volatile components may be stripped off. When a diluent is employed, it is preferably inert to the reactants and products formed and is generally used in an amount sufficient to insure efficient stirring.

Water, which can be present in the polyamino alkenyl or alkyl succinimide, may be removed from the reaction system either before or during the course of the reaction via azeotrope or distillation. After reaction completion, the system can be stripped at elevated temperatures (100°C to 250°C) and reduced pressures to remove any volatile components which may be present in the product.

Alternatively, a continuous system may be employed in which the alkenyl or alkyl succinic anhydride and polyamine are added at the front end of the system while the organic carbonate is added further downstream in the system. In such a continuous system, the organic carbonate may be added at any time after mixing of the alkenyl or alkyl succinic anhydride with the polyamine has occurred. Preferably, the organic carbonate is added within two hours after mixing of the alkenyl or alkyl succinic anhydride with the polyamine, preferably after the major portion of the amine has reacted with the anhydride.

In a continuous system, the reaction temperature may be adjusted to maximize reaction efficiency. Accordingly, the temperature employed in the reaction of the alkenyl or alkyl succinic anhydride with a polyamine may be the same as or different from that which is maintained for the reaction of this resulting product with the cyclic carbonate. In such a continuous system, the reaction temperature is generally between 0°C to 250°C; preferably between 125°C to 200°C; and most preferably between 150°C to 180°C.

The reaction of polyamino alkenyl or alkyl succinimides with cyclic carbonates is known in the art and is described in U.S. Patent 4,612,132, which is totally incorporated herein by reference.

A particularly preferred cyclic carbonate is 1,3-dioxolan-2-one (ethylene carbonate). Ethylene carbonate is commercially available or may be prepared by methods well-known in the art.

The molar charge of cyclic carbonate employed in the post-treatment reaction is based upon the theoretical number of basic nitrogens contained in the polyamino substituent of the succinimide. Thus, when 1 equivalent of tetraethylene pentamine ("TEPA") is reacted with two equivalents of succinic anhydride, the resulting bis succinimide will theoretically contain 3 basic nitrogens. Accordingly, a molar charge of 2 would require that two moles of cyclic carbonate be added for each basic nitrogen or in this case 6 moles of cyclic carbonate for each mole of bis succinimide prepared from TEPA. Mole ratios of the cyclic carbonate to the basic amine nitrogen of the polyamino alkenyl succinimide employed in the process of this invention are generally in the range of from about 1.5:1 to about 4:1; although preferably from about 2:1 to about 3:1.

As described in U.S. Patent No. 4,612,132, cyclic carbonates may react with the primary and secondary amines of a polyamino alkenyl or alkyl succinimide to form two types of compounds. In the first instance, strong bases, including unhindered amines such as primary amines and some secondary amines, react with an equivalent of cyclic carbonate to produce a carbamic ester. In the second instance, hindered bases, such as hindered secondary amines, may react with an equivalent of the same cyclic carbonate to form a hydroxyalkyleneamine linkage. Unlike the carbamate prod-

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in the base fuel is 10 to 10,000 weight parts per million, preferably from 30 to 2,000 weight parts per million, of the modified succinimide per part of base fuel. If other detergents are present, a lesser amount of the modified succinimide may be used.

The modified succinimide additives of this invention may also be formulated as a fuel concentrate, using an inert stable oleophilic organic solvent boiling in the range of about 150°F to 400°F. Preferably, an aliphatic or an aromatic hydrocarbon solvent is used, such as benzene, toluene, xylene or higher-boiling aromatics or aromatic thinners. Aliphatic alcohols of about 3 to 8 carbon atoms, such as isopropanol, isobutylcarbinol, n-butanol and the like, in combination with hydrocarbon solvents are also suitable for use with the fuel additive. In the fuel concentrate, the amount of the additive will be ordinarily at least 10 percent by weight and generally not exceed 70 percent by weight and preferably from 10 to 25 weight percent (all on a dry polymer basis).

The following examples are offered to specifically illustrate this invention. These examples and illustrations are not to be construed in any way as limiting the scope of this invention.

EXAMPLES

Example 1. Preparation of PIBSA 2200 (succinic ratio = 1.1)

A 35.186 Kg, 16 mol., sample of Parapol 2200 (a 2200 Mn polybutene available from Exxon Chemical Company) was charged to a reactor and heated to 232°C. During this time, the reactor was pressurized to 40 psig with nitrogen and then vented three times to remove oxygen. The reactor was pressurized to 24.7 psia. Then 1500 g maleic anhydride was added over a thirty-minute period. Then 4581 g maleic anhydride was added over a 4-hour period. The total charge mole ratio (CMR) of maleic anhydride to polybutene was 3.88. After the maleic anhydride addition was completed, the reaction was held at 232°C for 1.5 hour. Then the reaction was cooled and the pressure reduced to 0.4 psia to remove any unreacted maleic anhydride. To this was then added a light neutral diluent oil. This was heated to 160°C for 24 hours and was then filtered. This product was found to contain 37.68 wt. % actives and had a saponification number of 19.7 mg KOH/g sample. The succinic ratio was 1.1 based on a polybutene molecular weight of 2246 determined by GPC.

Example 2. Preparation of PIBSA 1300 (succinic ratio = 1.1)

The procedure of Example 1 was repeated except that Parapol 1300 (a 1300 Mn polybutene available from Exxon Chemical Company) was used instead of Parapol 2200. After dilution with diluent oil and filtration, this product was found to contain 49.6 wt. % actives and a saponification number of 42.2 mg KOH/g sample. The succinic ratio was 1.1 based on a polybutene molecular weight of 1300.

Example 3. Preparation of PIBSA 2200 (succinic ratio = 1.5)

Parapol 2200, 42.8 Kg, 19.45 mol, was charged to a reactor and the temperature was increased to 150°C. During this time, the reactor was pressurized to 40 psig with nitrogen and then vented three times to remove oxygen. Then at 150°C, maleic anhydride, 4294 g, 43.82 mol, and di-t-butylperoxide, 523 g, 3.58 mol, was added. The first 25% was added over 30 minutes. The remainder was then added over 11.5 hours. The CMR of maleic anhydride to polybutene was 2.25. The reaction was held at 150°C for one hour. Then the reactor was heated to 190°C for 1 hour to destroy any remaining di-t-butylperoxide. Then vacuum was applied to the reactor and the unreacted maleic anhydride was removed. This material was then diluted with a light neutral oil and filtered. The product after filtration had a saponification number of 31.6 mg KOH/g sample and contained 45.62 wt. % actives. The succinic ratio was 1.5 for this material based on a polybutene molecular weight of 2200.

Example 4A. Preparation of PIBSA 1300 (succinic ratio = 1.9)

Parapol 1300, 6.9 Kg, 47.6 mol, was charged to a reactor and the temperature was increased to 150°C. During this time, the reactor was pressurized to 40 psig with nitrogen and then vented three times to remove oxygen. Then at 150°C, maleic anhydride, 9332.66 g (95.23 mol), and di-t-butylperoxide, 1280 g (8.77 mol) was added over 5 hours. Then the reaction was maintained at 150°C for an additional 2 hours. The reaction was then heated to 190°C for 1 hour to destroy any residual peroxide. The pressure was then reduced to 0.4 psia and the excess maleic anhydride was removed. The product was found to contain 65.4 wt. % actives and had a saponification number of 94.5 mg KOH/g sample. The succinic ratio was 1.9 for this material based on a polybutene molecular weight of 1300.

2014-2015			
Year	Month	Day	Time
2014	12	15	10:00
2014	12	16	10:00
2014	12	17	10:00
2014	12	18	10:00
2014	12	19	10:00
2014	12	20	10:00
2014	12	21	10:00
2014	12	22	10:00
2014	12	23	10:00
2014	12	24	10:00
2014	12	25	10:00
2014	12	26	10:00
2014	12	27	10:00
2014	12	28	10:00
2014	12	29	10:00
2014	12	30	10:00
2014	12	31	10:00
2015	1	1	10:00
2015	1	2	10:00
2015	1	3	10:00
2015	1	4	10:00
2015	1	5	10:00
2015	1	6	10:00
2015	1	7	10:00
2015	1	8	10:00
2015	1	9	10:00
2015	1	10	10:00
2015	1	11	10:00
2015	1	12	10:00
2015	1	13	10:00
2015	1	14	10:00
2015	1	15	10:00
2015	1	16	10:00
2015	1	17	10:00
2015	1	18	10:00
2015	1	19	10:00
2015	1	20	10:00
2015	1	21	10:00
2015	1	22	10:00
2015	1	23	10:00
2015	1	24	10:00
2015	1	25	10:00
2015	1	26	10:00
2015	1	27	10:00
2015	1	28	10:00
2015	1	29	10:00
2015	1	30	10:00
2015	1	31	10:00

The following table shows the results of the 2014-2015 season. The data is presented in a table format with columns for Year, Month, Day, and Time. The table contains 31 rows of data, representing the days of the year 2014-2015. The data is presented in a table format with columns for Year, Month, Day, and Time. The table contains 31 rows of data, representing the days of the year 2014-2015.

TABLE I

(Analytical Data For Examples 5-19)					
Compound of Example No.:	DESCRIPTION	MEASURED			
		%N	TBN	VIS 100 (cSt)	SpGr (15°C)
5	bis HPA-X PIBSA 2200 (SR=1.1; A/P=0.44)	0.74	17	428	0.9106
6	bis TETA PIBSA 1300 (SR=1.1; A/P=0.5)	0.99	15	278	0.9300
7	bis HPA-X PIBSA 2200 (SR=1.5; A/P=0.5)	1.05	25	1688	0.9219
8	bis HPA-X PIBSA 1300 (SR=1.1; A/P=0.5)	1.55	36	272	0.9214
9	bis TETA PIBSA 2200 (SR=1.5; A/P=0.5)	0.64	10	1554	0.9339
10	bis TETA PIBSA 2200 (SR=1.1; A/P=0.44)	0.41	5	491	0.9093
11	EC bis HPA-X PIBSA 1300 (SR=1.1; A/P=0.5; EC/BN=2.0)	1.51	20	447	0.9393
12	EC bis TETA PIBSA 1300 (SR=1.5; A/P=0.5; EC/BN=2.0)	0.96	8	305	0.9282
13	bis TETA PIBSA 1300 (SR=1.5; A/P=0.5)	0.87	15	145	0.9120
14	bis HPA-X PIBSA 1300 (SR=1.5; A/P=0.5)	1.52	37	165	0.9142
15	EC bis TETA PIBSA 1300 (SR=1.5; A/P=0.5; EC/BN=2.0)	0.99	11	136	0.9156
16	EC bis HPA-X PIBSA 1300 (SR=1.5; A/P=0.5; EC/BN=2.0)	1.46	19	402	0.9330
17	EC bis HPA-X PIBSA 2200 (SR=1.1; A/P=0.44; EC/BN=2.0)	0.63	9	660	0.9188
18	EC bis HPA-X/DETA PIBSA 2200 (SR=1.1; A/P=0.40; EC/BN=2.4)	0.44	6	485	0.9132
19	EC bis HPA-X/DETA PIBSA 1300 (SR=1.1; A/P=0.5; EC/BN=2.0)	1.18	9.7	287	
Note: SR = succinic ratio A/P = amine/PIBSA CMR EC/BN = ethylene carbonate/basic nitrogen CMR					

Blending of Samples on an Equal Basis

We chose to blend and test the additives in Examples 5-19 on an equal wt. % actives basis. This was because we were trying to compare products from four different PIBSA's with different molecular weights and different succinic ratios, and two different amines with and without ethylene carbonate treatment. In order to do this, we calculated the %N and TBN that was expected for these compounds from the molecular formulas for a product that contained 40 wt. % actives. These data are reported in Table II. The succinimides from Examples 5-18 were then blended into the finished oil for testing at a concentration of 7.5% of the 40 wt. % actives material or at 3% on a dry polymer basis. The amounts of succinimides were adjusted to take into account the differences between the %N of the particular batch and the %N expected for the example. For Example 19, a 5% blend of 50 wt. % actives material or 3% on a dry polymer basis was made.

1	100	100	100	100
2	100	100	100	100
3	100	100	100	100
4	100	100	100	100
5	100	100	100	100
6	100	100	100	100
7	100	100	100	100
8	100	100	100	100
9	100	100	100	100
10	100	100	100	100
11	100	100	100	100
12	100	100	100	100
13	100	100	100	100
14	100	100	100	100
15	100	100	100	100
16	100	100	100	100
17	100	100	100	100
18	100	100	100	100
19	100	100	100	100
20	100	100	100	100
21	100	100	100	100
22	100	100	100	100
23	100	100	100	100
24	100	100	100	100
25	100	100	100	100
26	100	100	100	100
27	100	100	100	100
28	100	100	100	100
29	100	100	100	100
30	100	100	100	100
31	100	100	100	100
32	100	100	100	100
33	100	100	100	100
34	100	100	100	100
35	100	100	100	100
36	100	100	100	100
37	100	100	100	100
38	100	100	100	100
39	100	100	100	100
40	100	100	100	100
41	100	100	100	100
42	100	100	100	100
43	100	100	100	100
44	100	100	100	100
45	100	100	100	100
46	100	100	100	100
47	100	100	100	100
48	100	100	100	100
49	100	100	100	100
50	100	100	100	100
51	100	100	100	100
52	100	100	100	100
53	100	100	100	100
54	100	100	100	100
55	100	100	100	100
56	100	100	100	100
57	100	100	100	100
58	100	100	100	100
59	100	100	100	100
60	100	100	100	100
61	100	100	100	100
62	100	100	100	100
63	100	100	100	100
64	100	100	100	100
65	100	100	100	100
66	100	100	100	100
67	100	100	100	100
68	100	100	100	100
69	100	100	100	100
70	100	100	100	100
71	100	100	100	100
72	100	100	100	100
73	100	100	100	100
74	100	100	100	100
75	100	100	100	100
76	100	100	100	100
77	100	100	100	100
78	100	100	100	100
79	100	100	100	100
80	100	100	100	100
81	100	100	100	100

1. The first step is to identify the key components of the system. This includes the hardware, software, and data.

TABLE III - (PV-3344 TEST RESULTS)

Additive Compound of Example No.	Concentration of Additive (Wt. %)	TS (Pass \geq 8.0)	KL (Pass \geq 160)	CR (Pass = N)
5	1.6	10.0	203	N
	2.0	9.4	189	N
	2.4	8.8	196	N
	2.4	8.0	175	Y
	2.8	7.8	176	Y
	3.2	7.2	167	Y
6	1.6	10.8	218	N
	2.4	9.6	197	N
7	1.6	10.9	220	N
8	1.6	6.5	155	Y
	2.4	6.0	146	Y
9	1.6	11.7	232	N
10	1.6	12.5	244	N
	3.2	11.7	240	N
11	1.6	6.0	139	Y
	2.8	5.8	141	Y
12	1.6	10.9	216	N
13	1.6	11.2	224	N
	2.4	9.4	196	N
14	1.6	6.9	160	Y
	2.4	5.6	137	Y
15	1.6	11.7	233	N
	2.4	10.7	207	N
16	1.6	6.8	153	Y
	2.4	6.4	148	Y
17	1.6	9.0	188	N
	2.0	8.8	180	N
	2.4	8.8	196	N
	2.8	7.5	172	Y
	3.2	7.9	169	Y
18	1.6	12.1	238	N
	2.0	11.6	233	N
	2.4	11.1	220	N
	2.8	10.7	220	N
	3.2	10.0	206	N
19	1.6	10.1	186	N
	2.8	8.3	150	Y

The detergency properties of the additive compounds were then tested using the Sequence VE engine test procedure, as defined in ASTM Proposed Method:212. This test measures, among other things, average engine sludge (AES) and average engine varnish (AEV). The AES and AEV results for the compounds of Examples 5-19 are shown in Table IV. A dosage or treat rate level of 3.0% (on a dry polymer basis) was chosen as an appropriate concentration level for the Seq. VE test since treat rate levels exceeding 3% are generally too high for the resulting additive package to be priced competitively in the marketplace. Examples 17 and 18 were each run at concentration levels of 2.0 and 1.5% (on a dry polymer basis).

DATE	TIME	LOCATION	WIND	TEMP	HUMID	SEA	WAVE
10/10/77	0800	010	010	10.0	75	1	1
10/10/77	0900	010	010	10.0	75	1	1
10/10/77	1000	010	010	10.0	75	1	1
10/10/77	1100	010	010	10.0	75	1	1
10/10/77	1200	010	010	10.0	75	1	1
10/10/77	1300	010	010	10.0	75	1	1
10/10/77	1400	010	010	10.0	75	1	1
10/10/77	1500	010	010	10.0	75	1	1
10/10/77	1600	010	010	10.0	75	1	1
10/10/77	1700	010	010	10.0	75	1	1
10/10/77	1800	010	010	10.0	75	1	1
10/10/77	1900	010	010	10.0	75	1	1
10/10/77	2000	010	010	10.0	75	1	1
10/10/77	2100	010	010	10.0	75	1	1
10/10/77	2200	010	010	10.0	75	1	1
10/10/77	2300	010	010	10.0	75	1	1

1. The V-venter station has been used for 10 years. It is a good station for the study of the V-venter station in 1977.

DATE	TIME	LOCATION	WIND	TEMP	HUMID	SEA	WAVE
10/10/77	0800	010	010	10.0	75	1	1
10/10/77	0900	010	010	10.0	75	1	1
10/10/77	1000	010	010	10.0	75	1	1
10/10/77	1100	010	010	10.0	75	1	1
10/10/77	1200	010	010	10.0	75	1	1
10/10/77	1300	010	010	10.0	75	1	1
10/10/77	1400	010	010	10.0	75	1	1
10/10/77	1500	010	010	10.0	75	1	1
10/10/77	1600	010	010	10.0	75	1	1
10/10/77	1700	010	010	10.0	75	1	1
10/10/77	1800	010	010	10.0	75	1	1
10/10/77	1900	010	010	10.0	75	1	1
10/10/77	2000	010	010	10.0	75	1	1
10/10/77	2100	010	010	10.0	75	1	1
10/10/77	2200	010	010	10.0	75	1	1
10/10/77	2300	010	010	10.0	75	1	1

TABLE V (continued)

(EFFECT OF POLYBUTENE Mn)							
Compound of Example No.:	Succinic Ratio	Amine Type	Ethylene Carb onate Post- Treat- ment	Poly- butene Mn	PV-3344 TS	Seq. VE AES	Seq. VE AEV
8	1.1	HPA-X	No	1300	6.5	7.7	4.6
5	1.1	HPA-X	No	2200	10.0	9.4	5.6
11	1.1	HPA-X	Yes	1300	6.0	9.1	5.9
17	1.1	HPA-X	Yes	2200	9.0	9.4	5.9
14	1.5	HPA-X	No	1300	6.9	9.3	5.4
7	1.5	HPA-X	No	2200	10.9	9.5	6.0
13	1.5	TETA	No	1300	11.2	9.1	5.1
9	1.5	TETA	No	2200	11.7	9.3	5.6
Average	-	-	-	1300	8.3	8.6	4.9
Average	-	-	-	2200	10.8	9.3	5.4

Table V demonstrates that a polyisobutene Mn of 2200 gives better PV-3344 and better Seq. VE results than a polyisobutene Mn of 1300.

TABLE VI

(EFFECT OF AMINE TYPE)							
Compound of Example No.:	Poly- butene Mn	Suc- cinic Ratio	Ethylene Carbonate Post- Treat- ment	Amine Type	PV-3344 TS	Seq. VE AES	Seq. VE AEV
6	1300	1.1	No	TETA	10.8	8.0	3.4
8	1300	1.1	No	HPA-X	6.5	7.7	4.6
10	2200	1.1	No	TETA	12.5	8.9	4.0
5	2200	1.1	No	HPA-X	10.0	9.4	5.6
9	2200	1.5	No	TETA	11.7	9.3	5.6
7	2200	1.5	No	HPA-X	10.9	9.5	6.0
12	1300	1.1	Yes	TETA	10.9	8.7	4.1
11	1300	1.1	Yes	HPA-X	6.0	9.1	5.9
13	1300	1.5	No	TETA	11.2	9.1	5.1
14	1300	1.5	No	HPA-X	6.9	9.3	5.4
15	1300	1.5	Yes	TETA	11.7	9.4	5.3
16	1300	1.5	Yes	HPA-X	6.8	9.4	6.4
Average	-	-	-	TETA	11.5	8.9	4.6
Average	-	-	-	HPA-X	7.9	9.1	5.6
17	2200	1.1	Yes	HPA-X	9.0	9.4	5.9

TABLE VIII

(CONCLUSIONS)			
	Better PV-3344 Performance	Better Seq. VE (AES) Performance	Better Seq. VE (AEV) Performance
A. Polyisobutene Mn (1300 or 2200)	2200	2200	2200
B. Post-Treatment (Yes or No) with ethylene carbonate	No (slightly)	Yes	Yes
C. Amine type			
1. TETA or HPA-X	TETA	HPA-X (slightly)	HPA-X
2. HPA or DETA/HPA-X	DETA/HPA-X	HPA-X (slightly)	HPA-X

Table VIII shows that the most desirable additives contain a 2200 Mn substituent, are derived from a polyamine having greater than 4 nitrogen atoms per mole, and are post-treated with ethylene carbonate.

While TETA appears to be the best amine type for PV-3344 performance, the concentration levels required for this amine type to achieve suitable Seq. VE performance (AEV results in particular) are unacceptable because they are too high to allow for a competitive treat rate. Accordingly, the amine should have greater than 4 nitrogen atoms per mole.

For multi-grade oil applications, the succinimide additive may be derived from a succinic anhydride having a succinic ratio of approximately 1.5. However, the viscosity index improvement which accompanies succinimides having succinic ratios of about 1.3 or greater is not always desirable. Instead, for some applications, such as single-grade oil formulation, a succinic ratio less than about 1.3, preferably closer to 1, is more desirable. Furthermore, Example 20 (made from the PIBSA of Example 4A) shows that succinic ratios of about 1.9 are unacceptable because gels are formed. Accordingly, succinic ratios greater than 1 but less than about 2 are acceptable, with succinic ratios less than about 1.7 preferred.

Succinimide additives having a 2200 Mn alkenyl or alkyl group which are derived from an amine having greater than 4 nitrogen atoms per mole, and which are post-treated with ethylene carbonate, are compatible with fluorocarbon seals at concentration levels for which they are excellent detergent additives. Such additive compounds (Examples 17 and 18) pass the Seq. VE test at low concentration levels and are desirable because less of the additive is needed in additive packages, thereby resulting in lower-cost oil formulations.

Claims

1. A lubricating oil composition comprising a major amount of an oil of lubricating viscosity and an effective amount of a modified polyamino alkenyl or alkyl succinimide sufficient to be compatible with fluorocarbon seals and simultaneously control engine sludge and varnish, wherein the modified succinimide comprises the succinimide reaction product of:
 - (i) an alkenyl- or alkyl-substituted succinic anhydride derived from a polyolefin having a Mn of about 2000 to about 2700 and a Mw/Mn ratio of about 1 to about 5; and
 - (ii) a polyalkylene polyamine having greater than 4 nitrogen atoms per mole;
 wherein the succinimide reaction product is post-treated with a cyclic carbonate.
2. A lubricating oil composition according to Claim 1 wherein the charge mole ratio of (ii) to (i) is from about 0.35:1 to about 0.6:1; and the charge mole ratio of cyclic carbonate to basic amine nitrogen in the succinimide reaction product is from about 1.5:1 to about 4:1.
3. A lubricating oil composition according to Claim 1 wherein the polyolefin has a Mn of about 2100 to about 2400.
4. A lubricating oil composition according to Claim 3 wherein the polyolefin has a Mn of about 2200.
5. A lubricating oil composition according to Claim 1 wherein the polyolefin is polybutene.

1. The first step is to identify the problem or question that needs to be answered. This involves understanding the context and the specific requirements of the task.

On 11/11/1964, the following information was received from the Bureau of the Census, Washington, D.C.:

4. The second part of the report, "The Role of the State in the Development of the Economy," discusses the importance of state intervention in the economy, particularly in the areas of infrastructure, education, and health care. It argues that the state has a responsibility to ensure that these services are provided to all citizens, regardless of their economic status. This part of the report also discusses the role of the state in regulating the private sector and in promoting economic growth and development.

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1. The first step is to identify the variables involved in the problem. In this case, the variables are the number of hours worked (H) and the number of units produced (Q).

1. The first step is to identify the key components of the system. This includes the hardware (CPU, memory, storage) and software (operating system, applications).

cyclic carbonate is ethylene carbonate, and the charge mole ratio of cyclic carbonate to basic amine nitrogen in the succinimide reaction product is from about 2:1 to about 3:1.

- 5 21. A lubricating oil concentrate according to Claim 19 wherein the polyolefin is polyisobutene having a Mn of about 2200, the succinic anhydride has a succinic ratio from about 1 to about 1.7, the polyalkylene polyamine comprises 20% by weight diethylene triamine and 80% by weight Union Carbide HPA-X heavy polyamine, the charge mole ratio of (ii) to (i) is from about 0.4:1 to about 0.5:1, the cyclic carbonate is ethylene carbonate, and the charge mole ratio of cyclic carbonate to basic amine nitrogen in the succinimide reaction product is from about 2:1 to about 3:1.
- 10 22. A fuel composition comprising a hydrocarbon boiling in the gasoline or diesel range and from about 10 to about 10,000 weight parts per million on a dry polymer basis of a modified polyamino alkenyl or alkyl succinimide comprising the succinimide reaction product of:

 - 15 (i) an alkenyl- or alkyl-substituted succinic anhydride derived from a polyolefin having a Mn of about 2000 to about 2700 and a Mw/Mn ratio of about 1 to about 5; and
 - (ii) a polyalkylene polyamine having greater than 4 nitrogen atoms per mole;
wherein the succinimide reaction product is post-treated with a cyclic carbonate.
- 20 23. A fuel concentrate comprising an inert stable oleophilic organic solvent boiling in the range of 150°F to 400°F and from about 10 to about 70 weight percent on a dry polymer basis of a modified polyamino alkenyl or alkyl succinimide comprising the succinimide reaction product of:

 - 25 (i) an alkenyl- or alkyl-substituted succinic anhydride derived from a polyolefin having a Mn of about 2000 to about 2700 and a Mw/Mn ratio of about 1 to about 5; and
 - (ii) a polyalkylene polyamine having greater than 4 nitrogen atoms per mole;
wherein the succinimide reaction product is post-treated with a cyclic carbonate.

